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An Introduction to the TI-82 Graphing Calculator

Written by Mark Govatos

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Introduction

An Introduction to the TI-82 Graphing Calculator is intended to help students become familiar with the TI-82 graphing calculator. Each lesson leads students step-by-step through problems and solutions which highlight some of the most useful features and commands on the TI-82. Extra problems are provided at the end of some lessons for students to practice.

As students work through the activities, they will gain proficiency in how to use the calculator and will no doubt discover many more applications for the TI-82 than those presented in this book.

Encourage students to seek out other TI-82 users. There are some outstanding calculator programs currently in circulation which you may find on school bulletin board systems in your area or on calculators of students and teachers from other schools.

Acknowledgments

I wish to thank Crossroads School and the Summer Programs Office for giving me the opportunity to write and test these lessons.

I also want to thank Richard Sisley and Steve Johnson at the Pasadena Polytechnic School for showing me the power and potential of the new calculator technology during their August 1994 workshop at Occidental College.

Finally, I want to thank Texas Instruments for their excellent product line, including the TI-Graph Link™ software which was used to put this project together.

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Getting Started

Battery Installation and Systems

The TI-82 has two battery systems which use two different kinds of batteries. You can see both systems when you install the four alkaline batteries that come with your calculator. The round battery (already installed in the calculator) is a back-up system which will preserve the memory of your calculator should your alkaline system fail.

Turning the TI-82 On and Off

Press ON to turn the TI-82 on and 2nd **OFF** to turn it off. If you forget to shut off your calculator, the TI-82 will shut off automatically in about five minutes. This feature will prolong the life of your batteries. When the calculator is turned on, the display shows the last thing that was on it.

Adjusting the Screen Contrast

To make the pixels on the TI-82 view screen darker, press 2nd and hold down the "scroll up" key (the dark blue rectangular key with the white triangle pointing upward ▲). As the screen gets darker, you will see increasing numbers in the top right corner. To lighten the screen, press 2nd and hold down the "scroll down" key ▼.

Calculator Memory

The TI-82 has about 28k of memory which can be used to store programs, numbers, lists of data, and other items. This is a significant amount of memory which will enable you to keep several large programs on your calculator. However, as you accumulate programs on the TI-82 (see the sections on Programming and Linking on pages 43–46), you may want to delete selected items from your calculator's memory to add more different or more updated programs. To do this, press 2nd **MEM** and choose 2:Delete from the MEMORY menu.

From the DELETE FROM menu which follows this screen, you can delete specific lists, matrices, programs, etc., by pressing ENTER next to each item you want to remove. To exit this area, press 2nd **QUIT**.

You may also decide to reset your calculator's memory completely by choosing 3:Reset from the MEMORY menu above. Be aware, however, that reseting a calculator's memory will permanently erase *all* of the data stored in that calculator; *everything* will be lost. So if you are working on a calculator which belongs to someone else, you should never use these commands.

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Basic Calculations

Use the TI-82 calculator to evaluate the problems below.
Express decimal answers accurate to four decimal places.

a. $13 + 51$

b. $76 - 249$

c. $12.2 * 35.6$

[1]**d.** $-4 * 83$

e. $45.6 - (-11)$

[2]**f.** 25^2

g. -25^2

h. $(-25)^2$

i. $48^2 - 4(16)(-5)$

j. $185 \div 15$

k. $\log 1000$

[3]**l.** $\dfrac{6.2 - 3}{8}$

[4]**m.** $\sqrt{1521}$

[5]**n.** 2^7

[6]**o.** $\sin \pi$

p. $\sqrt{5^2 - 3^2}$

q. $\pi/2$

r. $\cos\left(\pi/3\right)$

---

[1] Hint: Use the gray (–) key for this problem.

[2] Hint: Use the x^2 key.

[3] Hint: Enter this as (6.2–3)/8.

[4] Hint: The square root key is above the x^2 key.

[5] Hint: Enter this as 2^7.

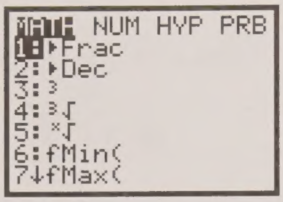
[6] Hint: π is above the ^ key.

Name ______________________________ Date ______________

Working With Fractions

The ">Frac" Command

1. Type the number 4.25. Then press the MATH key. The following screen will appear:



Press ENTER twice. What value appears? ______________________

2. Convert 3.14 to a fraction using the command described above. ______________________

3. Even though there is a similar command in the MATH menu to change a fraction to a decimal, the quickest way to convert a fraction to a decimal is to simply type the fraction and then press ENTER. Try it on the fraction $5/8$. What value appears? ______________________

4. To change a mixed numeral to a decimal, add a "+" sign between the whole and fractional part of the mixed numeral. For example, $16\ 4/5$ can be keyed in as $16 + 4/5$ to arrive at the decimal 16.8. What is $12\ 9/25$ expressed as a decimal? ______________________

5. Use the MATH 1:>Frac command to change $12\ 9/25$ to an improper fraction. ______________________

6. Use the calculator to evaluate $6\ 5/12 + 4\ 3/4$. Express your answer as an improper fraction and a mixed numeral. ________________ ________________

7. Perform the operations below on the calculator. Add parentheses as needed, and express your answers as improper fractions and mixed numerals.

[1]**a.** $7/2 - 4/9 =$ ________________ ________________

[2]**b.** $2\ 3/8 \times 3\ 1/3 =$ ________________ ________________

---

[1] Hint: Enter this as (7/2) – (4/9).

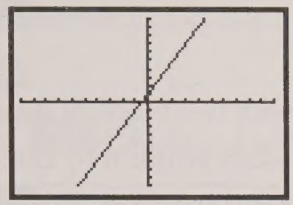
[2] Hint: Enter this as (2 + 3/8) * (3 + 1/3).

Name ____________________ Date ____________

Graphing and Locating Points

The "TRACE & ZOOM" Technique

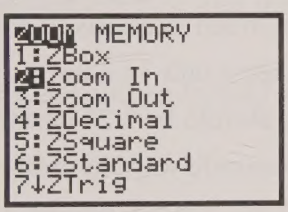
1.a. Use the **Y=** key to graph $Y_1 = 2x + 1$. Your screen should look like the following:



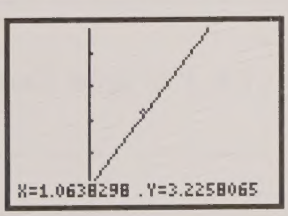
b. Press the **TRACE** key and scroll to approximate the value of Y_1 when x approaches 1. What are the closest values of x and Y_1 that you find? Express your answers accurate to four decimal places.

$x =$ ____________, $Y_1 =$ ____________

c. Press **ZOOM** and select 2:Zoom In. (See below.)



Press **ENTER** (you may have to press **ENTER** twice) and your graph will be magnified. (See below.)



Press **TRACE** again and scroll to approximate the value of Y_1 when x gets very close to 1. You should be able to get closer than your estimate in question b above. What are the closest values of x and Y_1 that you find in this magnification? Express your answers accurate to four decimal places.

$x =$ ____________, $Y_1 =$ ____________

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d. Press ZOOM, then 2:Zoom In and ENTER again to further magnify your graph (you may have to push ENTER twice again). Then use the TRACE and scroll keys again to approximate the value of Y_1 when x gets close to 1. You should be able to get even closer than your estimate in question **c**. What are the closest values of x and Y_1 that you find this time? Express your answers accurate to four decimal places.

x = ______________, Y_1 = ______________

By this time, you should notice that your answer to Y_1 is very close to the number 3. This seems reasonable since substituting 1 for x in the expression $2x + 1$ yields $2 \cdot 1 + 1$ which equals 3.

2. Use the trace and zoom technique described in question 1 with two magnifications to calculate the value of $Y_1 = -x^2 + 4x + 2$ when $x = 3$. You need to begin this problem by entering $Y_1 = -x^2 + 4x + 2$ in the Y= menu and by selecting 6:ZStandard from the ZOOM menu to restore your graph to its original magnification. What answer does Y_1 appear to be when $x = 3$?

Y_1 = ______________

Important note: The trace and zoom technique is a popular way to locate points on a graphing calculator. However, using this method may require two or more magnifications to ensure accuracy to within two decimal places. This can be very time consuming, especially in a testing situation. Furthermore, writing an answer like 2.2535 for an answer which should be 2.25 exactly will probably annoy your teacher and cost you points. There are much more accurate ways to locate points with a graphing calculator. See the lesson on the "value" command and the "table function" (pages 9–11).

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Locating Points

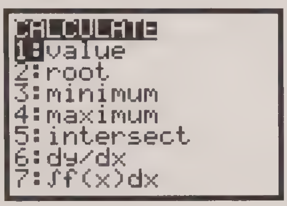
The "value" Command

1. To find the exact value of $Y_1 = 2x + 3$ when $x = 1.72$, follow **a–d** below.

a. In the Y= menu, let $Y_1 = 2x + 3$. Make sure your ZOOM is set to 6:ZStandard.

b. Press GRAPH.

c. Next, press 2nd **CALC** and select 1:value. (See below.) Press ENTER.



d. At this point, you should see your graph along with "Eval X=" at the bottom of the screen. Type in the number 1.72 and press ENTER. What answer do you get? ____________

2. Use 2nd **CALC** 1:value to find the value of $Y_1 = 2x + 3$ when:

a. $x = 1$. ____________

b. $x = -2$. ____________

c. $x = 3.57$. ____________

3. What is the exact value of Y_1 if $Y_1 = -(\frac{1}{2})x + 4$ and:

a. $x = 4$? ____________

b. $x = -1.7$? ____________

4. What is the exact value of Y_1 if $Y_1 = -x^2 + 3x + 4$ and:

a. $x = 2.5$? ____________

b. $x = -1.5$? ____________

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The Table Function

1. One of the most useful and unique features of the TI-82 is its table function. This feature is perfect for constructing tables of values for your graphs. Below is an example of how to use it.

a. Graph $Y_1 = 0.3x + 2$.

b. Press **2nd** **TblSet**. You should see two columns of numbers similar to the one below.

X	Y_1	
-1	1.7	
0	2	
1	2.3	
2	2.6	
3	2.9	
4	3.2	
5	3.5	

X= -1

The values in these columns represent x and y values for the equation $Y_1 = 0.3x + 2$.

c. If the values in the x column are integers, then find Y_1 when:

i. $x = 0$. ____________________

ii. $x = 1$. ____________________

iii. $x = 2$. ____________________

iv. $x = 5$. ____________________

v. $x = -4$. ____________________

(Hint: You will probably have to scroll up or down within the x value column to find all the corresponding Y_1 values for questions **i–v** above.)

If the values in the x column are not integers, you can change them into integers by pressing **2nd** **TblSet** and entering an integer (-2, for example) next to "TblMin=" and the number 1 next to "Δ Tbl=". (See below.)

```
TABLE SETUP
 TblMin=-2
 ΔTbl=1
Indpnt: Auto Ask
Depend: Auto Ask
```

Name ______________________ Date ______________

2. Use the table function to find y values for the equation $Y_1 = 5 - 2x^2$ when:

a. $x = 0.5$. ____________

b. $x = 1.5$. ____________

c. $x = -3.5$. ____________

(Hint: For this problem, change your table settings by pressing 2nd **TblSet** and setting "Δ Tbl=.5".)

3. Press 2nd **TblSet** again. Let "TblMin=0" and "Δ Tbl=-2". Then use 2nd **TABLE** to find the values of $Y_1 = \frac{1}{2}x + 3$ when:

a. $x = -8$. ____________

b. $x = -12$. ____________

c. $x = 6$. ____________

Notice in this example that the values for x decrease as you scroll down through the table.

4. Complete the table below for $Y_1 = x^2 - 5x$.

x	y
1.5	
1.6	
1.7	
1.8	
1.9	
2.0	
2.1	
2.2	
2.3	

Name ______________________ Date ______________

Locating Zeros and Roots

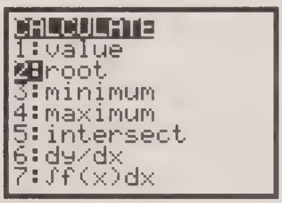
The "root" Command

1. To find the roots (or zeros) of $Y_1 = x^2 - 7x + 7$, follow **a–g** below and on page 13.

a. Graph $Y_1 = x^2 - 7x + 7$. Make sure ZOOM is set to 6:ZStandard.

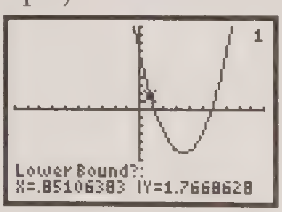
b. Notice the number of roots. In how many places does the graph of Y_1 cross the x-axis? ________

c. Press 2nd **CALC** and select 2:root. (See below.)



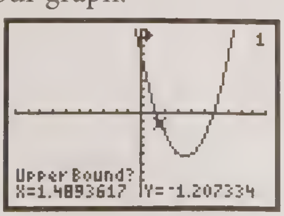
Press ENTER.

d. You should see your graph along with a prompt which says "Lower Bound?". Scroll to a point on your graph just left of the lefthand zero on your graph.



Press ENTER.

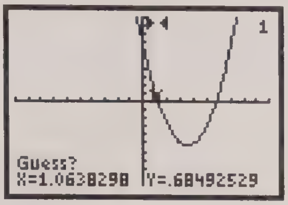
e. When you see the prompt "Upper Bound?", scroll to a point just to the right of the lefthand zero on your graph.



Press ENTER.

Name ______________________________ Date ______________

f. When you see the prompt "Guess?", scroll close to the point which you think is the zero.



Press ENTER.

g. What do you see written at the bottom of your screen? ______________________

____

____

The x-value is one of the two roots for the equation $Y_1 = x^2 - 7x + 7$. This means that it is a solution to the equation $x^2 - 7x + 7 = 0$. You may notice, however, that the number for Y at the bottom of your screen (-1E-13) does not appear to equal 0. Actually, the notation -1E-13 means -1×10^{-13} or -.0000000000001. You should think of this number as 0, since it is very close to 0.

2. Use the 2nd **CALC** 2:root command to find the other root of $Y_1 = x^2 - 7x + 7$. ____________

3. What are the roots of $Y_1 = .25x^3 - 2.175x^2 + 2.775x + 5.2$? ______________________

4. a. What is the root of $Y_1 = -2x + 4.75$? ______________________

b. Express your answer to **4a** as an improper fraction. ______________________

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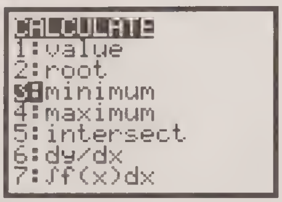
Finding Extrema: Maximum and Minimum Points

The “minimum” and “maximum” Commands

1. To find the minimum value of $Y_1 = x^2 + 3x + 4$, follow **a–h** below and on page 15.

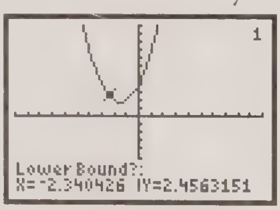
a. First, graph $Y_1 = x^2 + 3x + 4$ in the [Y=] menu. Your [ZOOM] should be set at 6:ZStandard.

b. Select [2nd] **CALC** and then 3:minimum. (See below.)



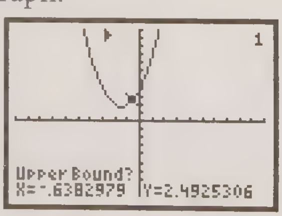
Press [ENTER].

c. You should see a prompt which says “Lower Bound?”. Scroll to a point on your graph just to the left of the minimum on your graph.



Press [ENTER].

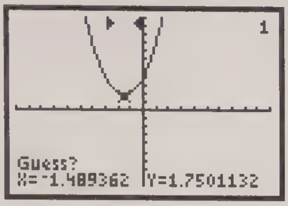
d. When you see the prompt “Upper Bound?”, scroll to a point just to the right of the minimum on your graph.



Press [ENTER].

Name ______________________________ Date ______________

e. When you see the prompt "Guess?", scroll as close to the minimum point as you can get.



Press ENTER.

f. What do you see written at the bottom of your screen? ______________________________

____

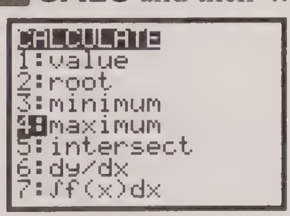
g. Your x-value might have several decimal places, but your y-value should be concise. If you were to choose a more concise (i.e., shorter) x-value close to the number at the bottom of your screen, what number would you choose? ______________

h. Use the 2nd **CALC** 1:value command to find the y-value which corresponds to your more concise x-value in question **g** above. Is your y-value the same as it was in question **f**? __________

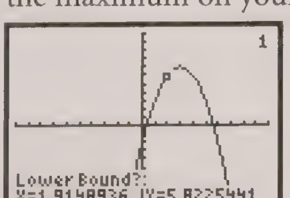
2. The procedure for finding the maximum value of a curve is similar to finding the minimum value. To find the maximum value of $Y_1 = -x^2 + 6x - 2$, follow **a–g** below and on page 16.

a. First, graph $Y_1 = -x^2 + 6x - 2$ in the Y= menu.

b. Select 2nd **CALC** and then 4:maximum.



c. You should see a prompt which says "Lower Bound?". Scroll to a point on your graph just to the left of the maximum on your graph.



Press ENTER.

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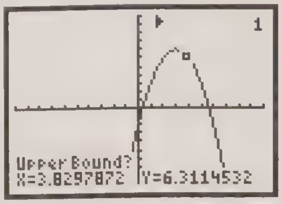
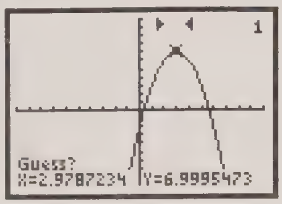
d. When you see the prompt “Upper Bound?”, scroll to a point just to the right of the maximum on your graph.



Press ENTER.

e. When you see the prompt “Guess?”, scroll as close to the maximum point as you can get.



Press ENTER.

f. What do you see written at the bottom of your screen? ______________________________

____

g. If you were going to choose concise values for the *x* and *y* coordinates of this maximum point, what values would you choose?

$x =$ ____________, $y =$ ____________

3. The equation $Y_1 = x^3 + x^2 - 6x$ has a relative maximum point in quadrant II and a relative minimum point in quadrant IV. Use your calculator to determine the coordinates of these points. Write your answers accurate to four decimal places.

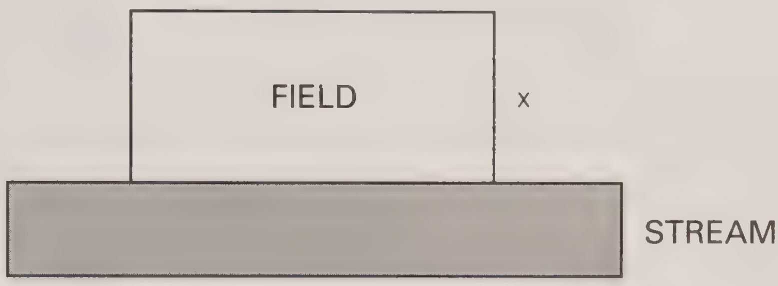
a. maximum = ____________________

b. minimum = ____________________

Name ______________________________ Date ______________

An Area Problem

Suppose you need to enclose a rectangular field on three sides with 45 meters of fence. The fourth side of the field is bordered by a stream. (See the picture below.)



1. Write an equation which expresses the area (A) of the field in terms of x, where x is the side of the field perpendicular to the stream.

A = ______________________

2. Use the graph of the equation above and the graphing calculator to find the maximum area of a field enclosed on three sides by 45 meters of fencing.

Hint: You will need to change your WINDOW settings to

```
WINDOW FORMAT
 Xmin=0
 Xmax=30
 Xscl=0
 Ymin=-50
 Ymax=300
 Yscl=0
```

Select 2nd **QUIT** to exit the WINDOW menu.

maximum area = ______________________

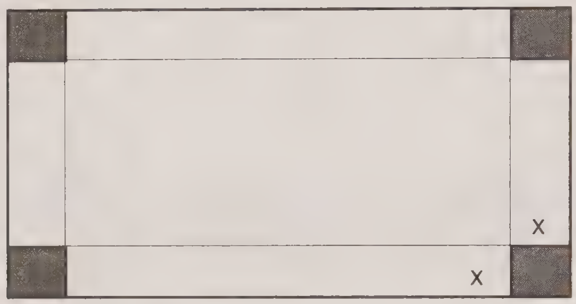
3. What are the dimensions of the field in question **2** above? Express your answers accurate to two decimal places.

dimensions = ____________ × ____________

Name ______________________ Date ______________

A Volume Problem

It is possible to construct an <u>open box</u> by cutting out squares from the corners of a single sheet of cardboard and then folding up the sides. (See the picture below.)

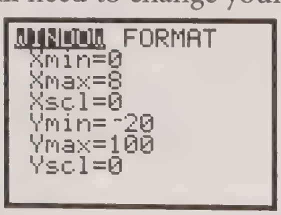


1. Suppose the dimensions of the cardboard sheet above are 9" by 12". Write an equation which expresses the volume (V) of the box in terms of x, where x is the depth of the box.

V = ______________________

2. Use the graph of the equation above and a graphing calculator to find the maximum volume of an open box constructed from a 9" by 12" sheet of cardboard.

Hint: You will need to change your WINDOW settings to



Select 2nd **QUIT** to exit the WINDOW menu.

maximum volume = ______________________

3. What are the dimensions of the box in question **2** above? Express your answers accurate to two decimal places.

dimensions = ______________ × ______________ × ______________

Name ______________________________ Date ______________

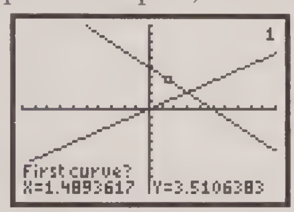
Intersections of Graphs

The "intersect" Command

1. To find the intersection of $y = -x + 5$ and $y = \frac{2}{3}x$, follow **a–e** below.

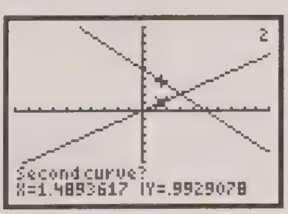
a. Graph $Y_1 = -x + 5$ and $Y_2 = \frac{2}{3}x$. Be sure ZOOM is set at 6:ZStandard.

b. Press 2nd **CALC** and then select 5:intersect. You should see your graph along with a prompt which says "First curve?" at the bottom of the screen. Scroll to a point close to (but not quite on top of) the intersection point.



Then press ENTER.

c. At this point, you should see a prompt which says "Second curve?" and your cursor will now be flashing on the second equation's graph. Notice the number 2 in the upper right corner of your screen.



Press ENTER.

d. When you see the prompt "Guess?", scroll as close to the intersection as you can get and press ENTER.

e. What do you see written at the bottom of your screen? ______________________
This ordered pair is the intersection of $y = -x + 5$ and $y = \frac{2}{3}x$.

Name ______________________________ Date ______________

2. a. Graph $Y_1 = x^2 - 4x - 3$ and $Y_2 = -x + 1$.

b. How many intersection points do these graphs have? ______________________

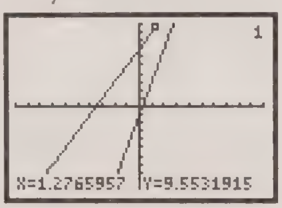
c. Use the 2nd **CALC** 5:intersect command described in questions **1 b–d** to find the 4th quadrant intersection point of these two graphs.

$x =$ ____________, $y =$ ____________

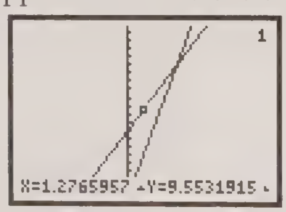
d. What are the coordinates of the 2nd quadrant intersection point of these two graphs?

$x =$ ____________, $y =$ ____________

3. Find the intersection of $y = 2x + 7$ and $y = 4x - 1$. If your calculator is showing the 6:ZStandard viewing screen, you will notice that the intersection of these two graphs is not on the screen. To see the intersection point quickly, select TRACE and then scroll right on one of the graphs in the direction where you think the intersection point will be.



Before the trace prompt disappears from the viewing screen, press ENTER and a new viewing screen will appear similar to the one below.



You should see the place where these two graphs cross. If not, repeat this procedure until you are able to see the intersection of the two graphs.

Use the 2nd **CALC** 5:intersect command to find the intersection of these two graphs. Write your answer as an ordered pair.

____

Name ______________________________ Date ______________

Solving Quadratic Equations Without Paper and Pencil

1. a. In algebra, you learned to solve quadratic equations using a couple of different methods. Consider the equation $2x^2 + x = 6$. One way to solve this is with factoring.

$$2x^2 + x = 6$$

$$2x^2 + x - 6 = 0$$

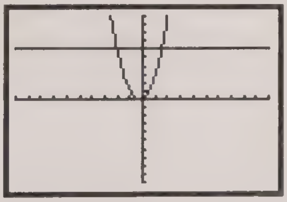
$$(2x - 3)(x + 2) = 0$$

$$2x - 3 = 0 \quad \text{or} \quad x + 2 = 0$$

$$x = 3/2 \quad \text{or} \quad x = -2$$

b. Another way to solve this is with the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where a, b, and c are the coefficients of $2x^2 + x - 6$.

c. Yet another way to solve the equation $2x^2 + x = 6$ involves thinking of the solutions to this equation as the intersections of two graphs whose equations are $Y_1 = 2x^2 + x$ and $Y_2 = 6$. Enter these two equations in the Y= menu and graph them.



d. Notice that these graphs intersect in two places. Use the 2nd **CALC** 5:intersect command to find the x-coordinates of each intersection point for these two graphs. Write only the x-coordinates of each intersection point.

____

Name ______________________________ Date ______________

Solving Harder Equations Without Paper and Pencil

1. Use two graphs and the 2nd **CALC** 5:intersect command to solve the equation $x^3 + 3x^2 - 5x - 7 = x + 1$.
What solution(s) do you get for x? ______________________

2. Use two graphs and the 2nd **CALC** 5:intersect command to solve the equation $\cos(x) = x$. For this equation, the 7:ZTrig setting from the ZOOM menu will provide you with a good viewing window. What solution(s) do you get for x? Express decimal answer(s) accurate to four decimal places. ______________________

3. Use two graphs and the 2nd **CALC** 5:intersect command to solve the equation $\sin(x) = 2$. Again, use the 7:ZTrig setting from the ZOOM for this problem. What solution(s) do you get for x? Express decimal answer(s) accurate to four decimal places. ______________________

4. Use two graphs and the 2nd **CALC** 5:intersect command to solve the equation $2^x = x^2$. For this equation, you may want to change your WINDOW settings to

```
WINDOW FORMAT
 Xmin=-5
 Xmax=5
 Xscl=1
 Ymin=-4
 Ymax=7
 Yscl=1
```

What solution(s) do you get for x? Express decimal answer(s) accurate to four decimal places.

____

Name ______________________________ Date ______________

Operations With Matrices

Addition and Subtraction

1. Perform the matrix operations below without using a calculator.

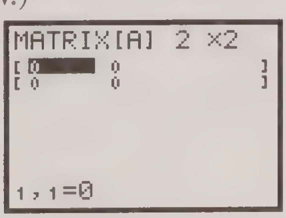
a. $\begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix} + \begin{bmatrix} 6 & -4 \\ 7 & 3 \end{bmatrix} = \begin{bmatrix} \underline{\quad} & \underline{\quad} \\ \underline{\quad} & \underline{\quad} \end{bmatrix}$

b. $\begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix} - \begin{bmatrix} 6 & -4 \\ 7 & 3 \end{bmatrix} = \begin{bmatrix} \underline{\quad} & \underline{\quad} \\ \underline{\quad} & \underline{\quad} \end{bmatrix}$

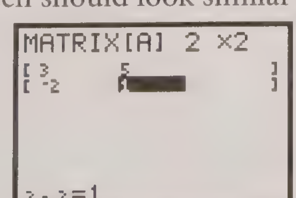
2. It is almost always quicker to add and subtract matrices without a TI-82 graphing calculator than with one. But for the purpose of introducing the TI-82's matrix capabilities, it is helpful to perform the calculations above on the TI-82.

Let $\begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix}$ be matrix A or [A] and let $\begin{bmatrix} 6 & -4 \\ 7 & 3 \end{bmatrix}$ be matrix B or [B].

a. Press MATRX, scroll to EDIT, and highlight 1:[A]. Press ENTER. The numbers, which are in the top right part of your screen, refer to the dimensions of the matrix. Since there are 2 rows and 2 columns in matrix A above, type **2** ENTER **2** ENTER. At the top of your screen, you should now see "MATRIX[A] 2 × 2", and the upper left number in the matrix should be highlighted. (See below.)



b. Type the following to construct matrix [A]: **3** ENTER **5** ENTER **–2** ENTER **1** ENTER.
Your screen should look similar to the one below.



Name ______________________________ Date ______________

c. Notice the numbers in the bottom left portion of your screen. The numbers separated by the commas refer to your position in the matrix. The first number identifies a row position, the second number identifies a column position, and the number after the "=" sign is the number which appears in the matrix at the identified position. Scroll up to the number 5 in matrix [A].

What do you see written at the bottom of the screen? ______________________________

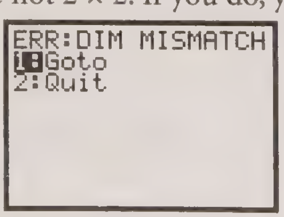
d. Press 2nd **QUIT** then MATRX EDIT 2:[B] ENTER. Establish the proper dimensions for this matrix by typing **2** ENTER **2** ENTER. Then enter the numbers in the matrix by typing **6** ENTER **–4** ENTER **7** ENTER **3** ENTER.

e. Press 2nd **QUIT** followed by MATRX NAMES 1:[A] + MATRX NAMES 2:[B].
At this point, you should see "[A] + [B]" on your screen. Press ENTER.
Write the matrix which appears on your screen at this point in the space below.
The TI-82 writes a matrix with double brackets at the beginning and end ("[[" and "]]").
Ignore the outer brackets when you write your answer below.

f. Now select MATRX NAMES 1:[A] – MATRX NAMES 2:[B] ENTER. What answer do you get?

____

Important note: When adding and subtracting matrices, they must have the same dimensions. In other words, it is possible to add or subtract a 2 × 2 matrix with another 2 × 2 matrix (or a 1 × 4 matrix with another 1 × 4), but you cannot add or subtract a 2 × 2 matrix with a matrix whose dimensions are not 2 × 2. If you do, you are likely to see the message below.



Name ______________________ Date ______________

Operations With Matrices

Multiplication, Inverses, and Determinants

1. Multiplying matrices without a calculator is a bit more complicated than adding and subtracting them, and the process of multiplying can be very time consuming if the matrices involved have dimensions higher than 2 × 2.

The result of multiplying $\begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix} * \begin{bmatrix} 6 & -4 \\ 7 & 3 \end{bmatrix}$ without a calculator would yield the matrix

$$\begin{bmatrix} (3)(6) + (5)(7) & (3)(-4) + (5)(3) \\ (-2)(6) + (1)(7) & (-2)(-4) + (1)(3) \end{bmatrix} \text{ or } \begin{bmatrix} 53 & 3 \\ -5 & 11 \end{bmatrix}.$$

2. Confirm that the answer in question **1** above is correct by performing the matrix product $\begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix} * \begin{bmatrix} 6 & -4 \\ 7 & 3 \end{bmatrix}$ on the TI-82. First, let $\begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix}$ be matrix [A] and let $\begin{bmatrix} 6 & -4 \\ 7 & 3 \end{bmatrix}$ be matrix [B].

Also, make sure that these matrices are entered into your calculator. If they are not, follow the procedures for entering them described in question **2** on pages 23–24. Be sure you type 2nd **QUIT** after you enter each matrix. Then select MATRX NAMES 1:[A] * MATRX NAMES 2:[B] ENTER.

What answer do you get? ______________________

3. Enter and multiply the matrices below on your graphing calculator. Write your results in matrix form.

a. $\begin{bmatrix} 7 & 1 & 1 \\ 0 & 2 & 6 \\ 3 & -2 & 1 \end{bmatrix} * \begin{bmatrix} 0 & 1 & 4 \\ 5 & -2 & 1 \\ -3 & 1 & -8 \end{bmatrix}$

b. $\begin{bmatrix} 5 & -2 \\ 0 & 2 \\ 1 & 1 \end{bmatrix} * \begin{bmatrix} 3 & 0 \\ 6 & 2 \end{bmatrix}$

Important note: When multiplying matrices, the number of columns of the first matrix must equal the number of rows of the second matrix. If these numbers are not equal, you will get an error message.

Name ______________________________ Date ________________

4. It is also easy to find the **inverse matrix** of a given matrix using the TI-82. Let $\begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$ be matrix [A].

a. Enter this matrix into your calculator followed by 2nd **QUIT**. Then select MATRX NAMES 1:[A] followed by X^{-1} and ENTER. What answer do you get?

b. You can verify that your answer in question **4a** is, in fact, the inverse matrix of matrix [A] by examining the products $[A] * [A]^{-1}$ and $[A]^{-1} * [A]$. These products should equal the **identity matrix.** What answer do you get when you multiply $[A] * [A]^{-1}$ and $[A]^{-1} * [A]$?*

5. **a.** You can also calculate the **determinant** of a matrix quickly with the TI-82.

CLEAR your screen and enter the following matrix as matrix [A]: $\begin{bmatrix} 7 & -3 \\ 5 & -4 \end{bmatrix}$

b. Press 2nd **QUIT**. Then select MATRX MATH 1:det ENTER

```
NAMES MATH EDIT
1:det
2:T
3:dim
4:Fill(
5:identity
6:randM(
7↓augment(
```

followed by MATRX NAMES 1:[A] ENTER. What answer do you get? ____________________

c. Use the TI-82 to calculate the determinant of $\begin{bmatrix} 5 & -8 & 4 \\ 4 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}$. ____________________

Important note: It is only possible to find the determinant of a **square matrix.** A square matrix has the same number of rows as columns (i.e., 2 × 2 or 3 × 3). If you try to find the determinant of a matrix which is not a square matrix, you are likely to see the message below.

```
ERR:INVALID DIM
1:Goto
2:Quit
```

*Here is a slight shortcut for calculating this product. First, store your answer to question **4a** in another matrix (such as [B]) by pressing STO▸ MATRX NAMES 2:[B] ENTER immediately after the answer to example **4a** appears on your screen. Then by multiplying [A] * [B] and [B] * [A], you multiply $[A] * [A]^{-1}$ and $[A]^{-1} * [A]$. This will save you the step of having to press X^{-1}.

Name ______________________________ Date ______________

Operations With Matrices

Solving Linear Systems of Equations

1. a. One useful application of matrices involves solving systems of linear equations. Consider the system

$$-2x - 3y = -26$$
$$3x + 4y = 36$$

In algebra, you learned to solve this system with either substitution, linear combination (a.k.a. Gaussian Elimination), or graphing. Here is yet another method which uses matrices.

First, think of this system as a product of matrices.

$$\begin{bmatrix} -2 & -3 \\ 3 & 4 \end{bmatrix} * \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -26 \\ 36 \end{bmatrix}$$

Let $[A] = \begin{bmatrix} -2 & -3 \\ 3 & 4 \end{bmatrix}$, and $[C] = \begin{bmatrix} -26 \\ 36 \end{bmatrix}$, so the above matrix equation can be written as

$$[A] * \begin{bmatrix} x \\ y \end{bmatrix} = [C]$$

If you multiply both sides of the matrix equation by $[A]^{-1}$, you get

$$[A]^{-1}[A] * \begin{bmatrix} x \\ y \end{bmatrix} = [A]^{-1}[C]$$

which becomes $\begin{bmatrix} x \\ y \end{bmatrix} = [A]^{-1}[C]^{*}$

since $[A]^{-1}[A] * \begin{bmatrix} x \\ y \end{bmatrix} = [I] * \begin{bmatrix} x \\ y \end{bmatrix}$ which equals $\begin{bmatrix} x \\ y \end{bmatrix}$

*This formula basically states that the solution of a linear system of equations is the product of the inverse of the coefficient matrix and the constant matrix. Order is important here. The matrix product $[C]\ [A]^{-1}$ will not yield the same result as $[A]^{-1}[C]$. Matrix multiplication is not commutative.

Name ______________________________ Date ______________

b. For the example, enter $\begin{bmatrix} -2 & -3 \\ 3 & 4 \end{bmatrix}$ into matrix [A] and $\begin{bmatrix} -26 \\ 36 \end{bmatrix}$ into matrix [C] of your calculator. You will have to press 2nd **QUIT** after entering matrix [A] and enter the correct dimensions of matrix [C]. What are the dimensions of matrix [C]? ______________

c. Press 2nd **QUIT** again after entering matrix [C]. Then use the MATRX NAMES menu and the x^{-1} key to enter $[A]^{-1}[C]$. Press ENTER. What is your solution?

You should think of the numbers in this matrix as solutions for x and y respectively.

2. Use the matrices and the $[A]^{-1}[C]$ formula described above to solve the system below.

$$\begin{aligned} 2x - 4y + 2z &= 16 \\ -2x + 5y + 2z &= -34 \\ x - 2y + 2z &= 4 \end{aligned}$$

Important note: This method for solving a system of equations will only work on a system which has one solution. Inconsistent systems should not be solved with the $[A]^{-1}[C]$ formula.

Name ______________________________ Date ______________

Plotting Data: Histograms

1. a. On a recent Advanced Placement Test in calculus, students received the scores below.

Student	Score
C. Smith	5
T. Jones	1
G. Cole	3
X. Nick	3
G. Wills	4
D. Cone	2
D. Sky	1
M. Poole	4
Q. Floyd	4
B. Ginger	5

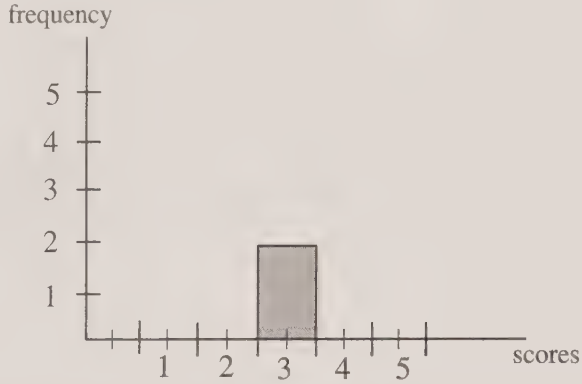
The Advanced Placement Test is graded on a 5-point scale where:

5 = extremely well-qualified
4 = well-qualified
3 = qualified
2 = possibly qualified
1 = not qualified

A student who earns a score of 3, 4, or 5 often earns college credit.

Name ______________________________ Date ______________

b. Graph this data as a histogram. Let the horizontal axis be the scores, and let the vertical axis be the frequency of the scores. Part of the histogram has already been drawn below. Complete the chart using the scores on page 29.

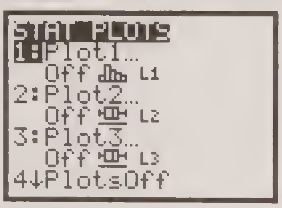


2. Now verify that your graph is correct by using the TI-82 calculator to check your work.

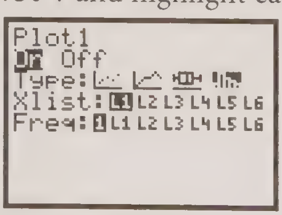
a. First, select Y= and CLEAR all equations.

b. Next, type 2nd **STAT PLOT** and then select the 4:PlotsOff. Press ENTER twice. You should see the word "Done".

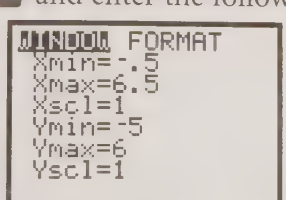
c. Now type 2nd **STAT PLOT** again. You should see a screen similar to the one below.



d. Select 1:Plot 1 and highlight each of the choices highlighted below.

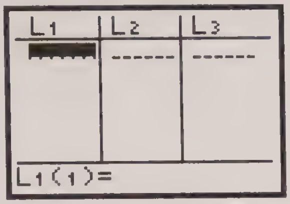


e. Press WINDOW and enter the following set-up:



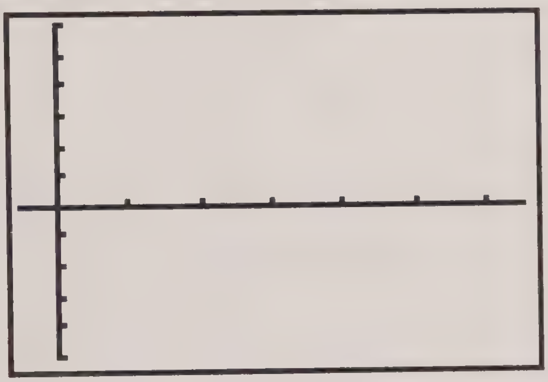
Name ______________________________ Date ________________

f. Press STAT, select 1:Edit, and then press ENTER. You should see a screen similar to the one below. If there are no numbers under L_1, go on to part **g**. If there are numbers under L_1, you can erase them by scrolling up and highlighting L_1, hitting CLEAR, and then scrolling down. Your screen should look like this:



g. Now enter each of the student's test scores from question 1a in L_1. After each score, press ENTER.

h. Press GRAPH. Copy the graph that appears on your screen on the axes below.



3. In this problem, you will record and graph some data from rolling dice.

a. Roll a single pair of dice about 20 times and record the sum of each roll in the chart below.[1]

Roll	Sum	Roll	Sum
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10		20	

[1]Hint: It is possible to simulate the roll of these dice with the following calculator program. For more about programming, see "Programming" (pages 43–45).

```
PROGRAM:DICEROLL
  :ClrHome
  :Disp "DICE ROLL"
  :Disp "SIMULATION"
  :ipart (rand*6)+1 ->D
  :ipart (rand*6)+1 ->E
  :Disp D
  :Disp E
```

Name ______________________________ Date ______________

b. Now construct a histogram which accurately represents your data. If you are using the TI-82, you will need to change your viewing window. The following window is recommended:

```
WINDOW FORMAT
 Xmin=-.5
 Xmax=13.5
 Xscl=1
 Ymin=-5
 Ymax=8
 Yscl=1
```

c. According to the data in this graph, what percent of the time did you roll a sum of 7?

____

[2]**d.** What is the actual probability of rolling a sum of 7 with two dice? ______________

[2]Hint: The probability of rolling a 7 with two dice is as follows:

$$\frac{\text{The total number of ways to roll a 7 with two dice}}{\text{The total number of ways to roll the dice}}$$

Name ______________________________ Date ______________

Plotting Data: Box and Whisker Plots

1. Suppose you need to analyze some scores from a recent quiz in your math class. The results of eleven students are given below.

STUDENT	SCORE (%)
Anita Fine	92
Vic Bear	75
Gale Hand	97
Shirley Cap	65
Lou Williams	87
Paul Gate	83
Bertha Dale	64
Eileen King	78
Clem Smith	52
Dawson Porter	87
Polly Cole	72

a. What is the **maximum** score in this list? ______________

b. What is the **minimum** score in this list? ______________

c. The **range** of a distribution (or list of numbers) is the difference between the maximum and minimum numbers in a list. What is the range of the scores in the list above? ______________

d. The **median** of a distribution is defined to be the middle number in a list. If a list has an even amount of numbers, then the median will be the average of the two middle numbers in the list. The list above has a total of 11 numbers. What is the median of the distribution above? ________

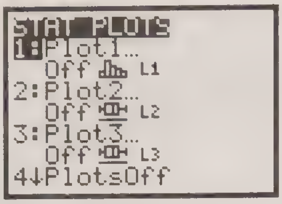
2. Now verify that your answers above are correct by using the TI-82.

a. First, select Y= and CLEAR all equations.

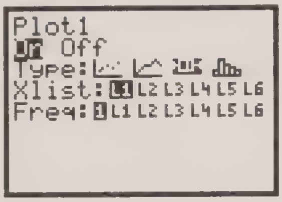
b. Next, type 2nd **STAT PLOT** and select 4:PlotsOff. Press ENTER. You should see the word "Done".

Name ______________________________ Date ______________

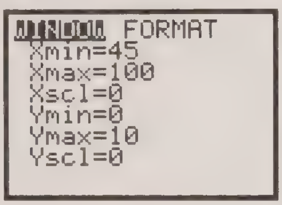
c. Now type **2nd** **STAT PLOT** again to see a screen similar to the one below.



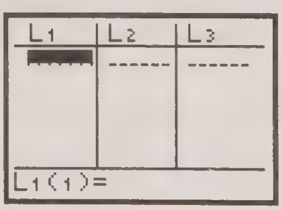
d. Select 1:Plot1 and highlight each of the choices below.



e. Press **WINDOW** and enter the following set-up:



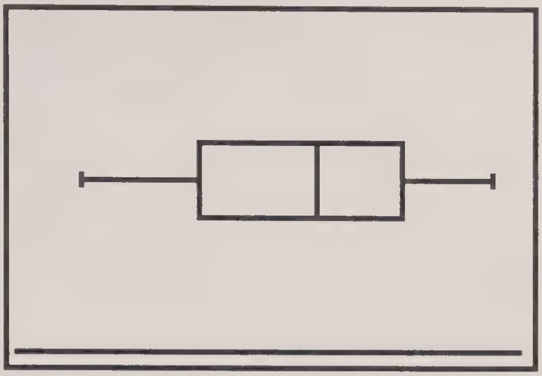
f. Press **STAT**, select 1:EDIT, and then press **ENTER**. You should see a screen similar to the one below. If there are no numbers under L_1, go on to question **g**. If there are numbers under L_1, you can erase them by scrolling up and highlighting L_1, pressing **CLEAR**, and then scrolling down.



g. Now enter each of the student's test scores from page 33 in L_1. After each score, press **ENTER**.

Name ______________________________ Date ______________

h. Press GRAPH. You should see a graph which resembles the one below. This graph is called a **box and whisker plot**.



i. Press TRACE. What do you see written at the bottom of your screen? ______________

j. Scroll to the extreme right side of your graph. What do you see written at the bottom of your screen? ______________

k. Scroll to the extreme left side of your graph. What do you see written at the bottom of your screen? ______________

l. The other values which show up as you scroll along the graph are the **first quartile** (Q1) and the **third quartile** (Q3) values of the distribution. The first quartile value represents the 25th percentile of the list, and the third quartile represents the 75th percentile of the list. What are the first and third quartiles of the distribution in question **2**?

Q1 = ______________

Q3 = ______________

Name ______________________________ Date ____________________

One Variable Statistics

The "1-Var Stats" Command

1. Another quick way to find the minimum, first quartile, median, third quartile, maximum, and other important information about a list involves using the 1-Var Stats command.

a. For this exercise, you will need to use the data from "Plotting Data: Box and Whisker Plots" (pages 33–35). Go back and enter the students' scores given at the beginning of that lesson in L_1 of your calculator.

b. Press STAT and then select CALC 1:1-Var Stats. Press ENTER.

```
EDIT CALC
1:1-Var Stats
2:2-Var Stats
3:SetUp…
4:Med-Med
5:LinReg(ax+b)
6:QuadReg
7↓CubicReg
```

c. At this point, you should see the words "1-Var Stats" on your screen. Press 2nd **L1** so that "1-Var Stats L1" appears on your screen. Press ENTER.

d. What you see here is some statistical information about the data in L_1. (See below.)

```
1-Var Stats
 x̄=77.45454545
 Σx=852
 Σx²=67818
 Sx=13.5156475
 σx=12.88666426
↓n=11
```

$\overline{x}$ is the **arithmetic mean**, or average, of all the numbers in the list. $\sum x$ is the **sum** of all the numbers in the list; $\sum x^2$ is the **sum of the squares** of all the numbers in the list; Sx is the **sample standard deviation** of the numbers; σx is the **population standard deviation** of the numbers in the list; and n is the number of numbers in the list.

e. Now scroll down to the end of the list and write the numbers which appear on your screen.

1-Var Stats

↑n= ____________	Med= ____________
minX= ____________	Q3= ____________
Q1= ____________	maxX= ____________

Name ______________________ Date ____________

Writing Linear Equations Given Two Points

The “LinReg” Command

1. a. Sketch a line segment in the space below. Use a straight edge.

b. Use a ruler to measure the length of the segment above in inches.

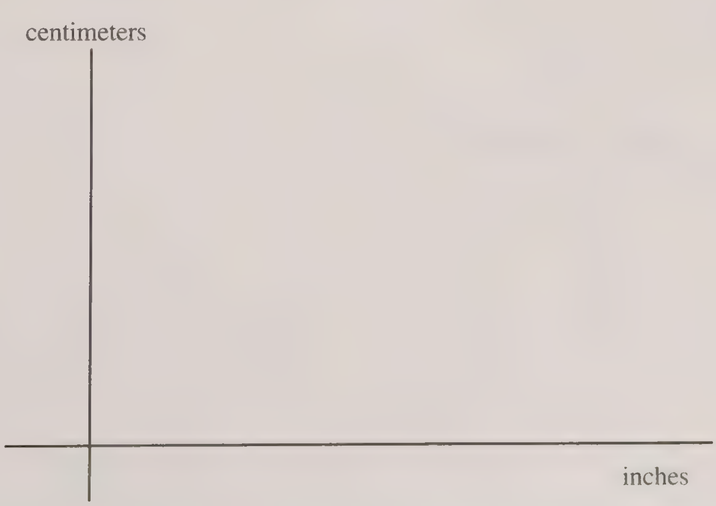
What is your answer? ____________

c. Use a ruler to measure the length of the segment in centimeters.

What is your answer? ____________

d. Write your answers to questions **b** and **c** as an ordered pair where the first coordinate is the measurement of the segment in inches and the second coordinate is the measurement of the segment in centimeters. ____________

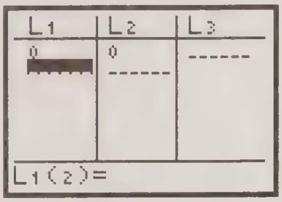
e. Plot the ordered pair on the axes below and label it point P. Then draw a segment from point P to point O, the origin of the graph. The origin is another data point because a segment of 0 inches will have a length of 0 centimeters.



Name ______________________________ Date ________________

2. Now use the TI-82 to find the equation of this graph by following **a–h** below and on page 39.

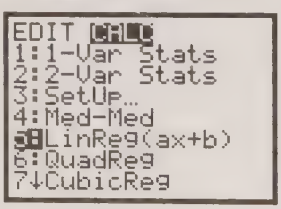
a. First, press STAT and select 1:Edit. Then enter the coordinates of points P and O in L_1 and L_2 (you may have to clear these lists first). L_1 will contain the *x*-coordinates of each ordered pair, and L_2 will contain the *y*-coordinates. Your screen should look like the one below except you will have the coordinates of point P also listed. The origin is already listed here.



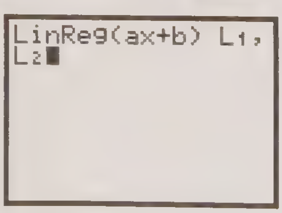
b. Next, press 2nd **STAT PLOT** and select 1:Plot1. Make sure that all the other plots are turned off and that all equations are cleared from the Y= menu. Then highlight each of the menu items highlighted in the screen below.

c. Press GRAPH and make sure that both data points are visible on the screen. It may be difficult to see the data point at (0, 0). You may also have to adjust your WINDOW in order to include point P in the graph.

d. Now press STAT, select CALC, and highlight 5:LinReg(ax+b). (See below.)



e. Press ENTER followed by 2nd **L1** , 2nd **L2** . (See below.)



Press ENTER.

Name ______________________________ Date ______________

f. Fill in the blanks below by writing what appears on your screen.

LinReg
y=ax+b
a= ____________
b= ____________
r=1

g. What you see are coefficients for an equation of the form $y = ax + b$. Plug in your a and b values to create an equation.

$y =$ ________________

h. Now press Y= and enter the equation above in Y_1. Press GRAPH. What do you notice?

____

____

3. The method above can be used to find any linear equation given two points on the line. Use STAT 1:Edit and the LinReg(ax+b) command to find an equation which converts degrees Celsius (°C) to degrees Fahrenheit (°F) given that:

0° C = 32° F
and
100° C = 212° F

Name ________________________________ Date ______________

Plotting Data: Scatter Plot Graphs

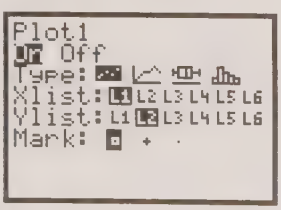
1. Ron Smith and his wife Eileen have a new baby boy named Ben. Their pediatrician has instructed them to weigh Ben every week for the first 8 weeks and keep a record of the baby's growth. Ron and Eileen recorded the data below.

Ben's Age	Ben's Weight
1 week	8 ½ lb.
2 weeks	9 ¼ lb.
3 weeks	9 ¾ lb.
4 weeks	9 ¾ lb.
5 weeks	10 ½ lb.
6 weeks	11 lb.
7 weeks	11 ½ lb.
8 weeks	11 ¾ lb.

Ron has asked you to create a **scatter plot graph** to represent the data from the list above. To do this, follow **a–h** below and on page 41.

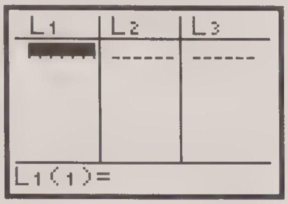
a. First CLEAR all equations from the Y= menu on your TI-82 calculator.

b. Then press 2nd **STAT PLOT** and select 1:Plot 1. Enter the following set up by highlighting each of the choices below:



Name ______________________________ Date ____________

c. Press STAT, select 1:Edit, and then press ENTER. You should see a screen similar to the one below. If there are no numbers under L_1 or L_2, go on to part **d**. If there are numbers under L_1 or L_2, erase them. To erase numbers in L_1 scroll up and highlight L_1, press CLEAR, and then scroll down. To erase data in L_2, scroll over and up to highlight L_2, press CLEAR, and then scroll down. If you return to the top of L_1, your screen should look like the one below.

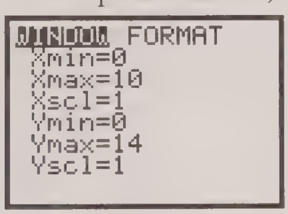


d. Now enter each of the week's numbers in L_1. After each score, press ENTER.

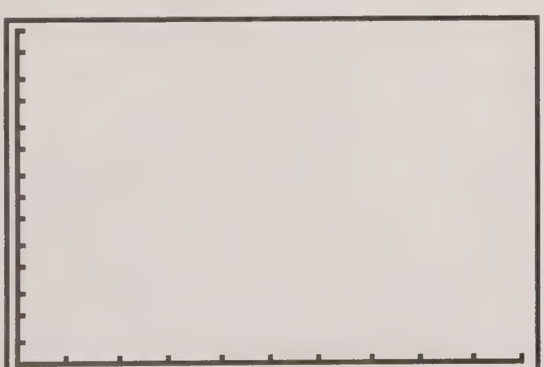
e. Then under L_2, enter each of the weights which correspond to the weeks, pressing ENTER after each weight. You may want to convert some of these weights to decimals.

f. Press GRAPH. Are all of your data points showing? ______________________________

You should see 8 points. If not, change your viewing WINDOW settings to the following:



g. Below, record the data as it appears on your calculator.



h. Verify that all the points you plotted are correct by pressing TRACE and scrolling over the points.

Name ______________________________ Date ________________

2. The data below is a list containing the winning Olympic Games times for the Men's 400-Meter Hurdles.

Year	Athlete (Country)	Time (sec.)
1920	Loomis (USA)	54
1924	Taylor (USA)	52.6
1928	Burghley (Great Britain)	53.4
1932	Tisdall (Ireland)	51.7
1936	Hardin (USA)	52.4
1948	Cochran (USA)	51.1
1952	Moore (USA)	50.8
1956	Davis (USA)	50.1
1960	Davis (USA)	49.3
1964	Cawley (USA)	49.6
1968	Hemery (Great Britain)	48.12
1972	Akii-Bua (Uganda)	47.82
1976	Moses (USA)	47.64
1980	Beck (E. Germany)	48.7
1984	Moses (USA)	47.75
1988	Phillips (USA)	47.19
1992	Young (USA)	46.78

a. Use the graphing calculator to make a scatter plot graph of this data. Don't forget to label your axes.

b. Perform a linear regression on this data using the STAT CALC 5:LinReg(ax+b) command.

What equation do you get? ______________________________

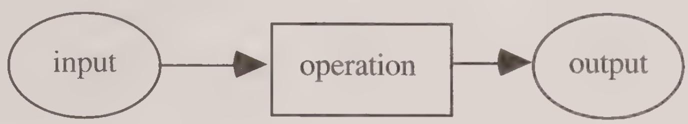
c. Take your equation from question **2b** and type it into Y_1 in the Y= menu. Press GRAPH. This line should pass through your scatter plot points.

Name ______________________________ Date ______________

Programming

It is possible to write your own programs for the TI-82. Programs give you the power to perform complicated or routine tasks quickly and accurately.

Most computer programs are organized according to the following model:

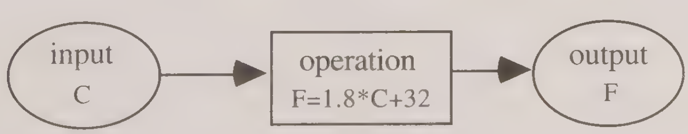


If you have a lot of programming experience, the model above will seem very simplistic. But if you do not have much experience with programming, you will probably find this model helpful as you start writing programs.

1. a. Write a program which will convert any Celsius temperature to a temperature in Fahrenheit. For this program, you will need to use the equation you found in question **3** at the end of "Writing Linear Equations Given Two Points" (pages 37–39). If you have not answered this question, the conversion formula is provided below.

$$\text{degrees Fahrenheit} = 1.8 * (\text{degrees Celsius}) + 32$$

Using the programming model above, our program will look something similar to the one below.



First, the calculator will prompt the user to input a temperature in degrees Celsius. The calculator will then perform the conversion operation. Finally, the calculator will output the temperature in degrees Fahrenheit.

Name ______________________________ Date ______________

These three steps require only three programming statements:

```
:Input "ENTER °C:",C
:1.8C+32 →F
:Disp "°F=",F
```

Notice that each statement begins with a colon (:) and that the command for output is the word Disp.

b. To enter this program into your calculator, press PRGM and scroll over to the word "NEW". You should see this screen:

```
EXEC EDIT NEW
1:Create New
```

Press ENTER.

c. After "NAME=", type in the letters **CELSFAHR** using the gray letters above the keys on your calculator. You will find the letter **C** above the PRGM key. As you type in the letters, notice that the cursor has a flashing "A" in it. This tells you that you are in the ALPHA mode. After you have finished typing **CELSFAHR**, press ENTER. You should see the following screen:

```
PROGRAM:CELSFAHR
:█
```

This will be where you will write the program.

d. Next, press PRGM and scroll over to "I/O" to get the following menu:

```
CTL I/O EXEC
1:Input
2:Prompt
3:Disp
4:DispGraph
5:DispTable
6:Output(
7↓getKey
```

Since "1:Input" is already highlighted, press ENTER. At this point, you should see the word Input at the top of your **CELSFAHR** program screen.

Name ______________________________ Date ________________

e. After the word "Input", type the following:

2nd **A-LOCK** " E N T E R ␣ 2nd **ANGLE** 1:° ENTER ALPHA C 2nd : ALPHA ", ALPHA C

Press ENTER.

f. On the next line, type 1.8 ALPHA C + 32 STO▸ ALPHA F.

Press ENTER.

g. Next, press PRGM, scroll to I/O, and select 3:Disp. Then type the following:

ALPHA " 2nd **ANGLE** 1:° ENTER ALPHA F 2nd **TEST** 1:= ALPHA ", ALPHA F.

Press ENTER.

Your program should look like this:

```
PROGRAM:CELSFAHR
:Input "ENTER °C
:",C
:1.8C+32→F
:Disp "°F=",F
:█
```

h. Now run your program. Press 2nd **QUIT**. Then press PRGM.

Highlight the program name CELSFAHR. Press ENTER.

Press ENTER again. After the prompt "ENTER °C:", type 40 followed by ENTER.

What appears on your screen? ______________________________

i. Use your program to convert the following Celsius temperatures:

5° C = ____________

37° C = ____________

-10° C = ____________

2. Write a program which will convert any measurement given in centimeters to inches. (Hint: There are 2.54 centimeters in 1 inch.)

Name ______________________ Date ______________

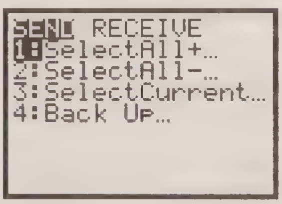
Linking

It is possible to write programs which perform much more complicated tasks than the ones described in "Programming" (pages 43–45). However, this often requires considerably more skill and patience. Fortunately, you do not have to be a great programmer to have great programs on your calculator. Linking gives you the power to share programs with other TI-82 users.

1. Give your **CELSFAHR** program to another user.

a. First, join the two calculators with a linking cable. Linking cables come with each calculator. You will find the cable insertion point at the bottom of each calculator. Press the cable in firmly.

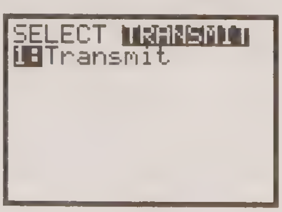
b. Both users should then press 2nd **LINK** to get the following screen:



c. The receiving calculator should scroll over to "RECEIVE" and wait.

d. The sending calculator should stay with the SEND menu above and select 3:SelectCurrent... This command allows the sender to choose and send individual items from the calculator's memory. The next screen the sender will see is a list of every item in the calculator's memory. Notice that this includes not only programs but lists, matrices, equations, etc.

e. The sender should highlight the **CELSFAHR** program and select ENTER. Then scroll over to "TRANSMIT" to get the following screen:



f. At this point, the receiver should select 1:Receive to see a "Waiting..." prompt.

g. The sender should now select 1:Transmit, and the word "Done" will appear when the transmission is complete. If an error statement appears, make sure the linking cables are firmly in place and repeat the procedures described above.

Answers

Basic Calculations
(page 5)

a. 64

b. -173

c. 434.32

d. -332

e. 56.6

f. 625

g. -625

h. 625

i. 2624

j. 12.3333

k. 3

l. 0.4

m. 39

n. 128

o. 0

p. 4

q. 1.5707

r. 0.5

Working With Fractions *(page 6)*

1. $^{17}/_{4}$

2. $^{157}/_{50}$

3. 0.625

4. 12.36

5. $^{309}/_{25}$

6. $^{67}/_{6}$; $11\,^{1}/_{6}$

7a. $^{55}/_{18}$; $3\,^{1}/_{18}$

7b. $^{95}/_{12}$; $7\,^{11}/_{12}$

Graphing and Locating Points
(pages 7–8)

1b. $x = 1.0638$;
$Y_1 = 3.1276$

1c. $x = 1.0106$;
$Y_1 = 3.0212$

1d. $x = 0.9973$;
$Y_1 = 2.9946$

2. 5

Locating Points
(page 9)

1d. 6.44

2a. 5

2b. -1

2c. 10.14

3a. 2

3b. 4.85

4a. 5.25

4b. -2.75

The Table Function
(pages 10–11)

1ci. 2

1cii. 2.3

1ciii. 2.6

1civ. 3.5

1cv. 0.8

2a. 4.5

2b. 0.5

2c. -19.5

3a. -1

3b. -3

3c. 6

4.

x	y
1.5	-5.25
1.6	-5.44
1.7	-5.61
1.8	-5.76
1.9	-5.89
2.0	-6
2.1	-6.09
2.2	-6.16
2.3	-6.21

Locating Zeros and Roots
(pages 12–13)

1b. 2

1g. Root
X = 1.2087122
Y = -1E -13

2. Root
X = 5.7912878
Y = 0

3. $x = -1$; $x = 3.2$;
$x = 6.5$

4a. $x = 2.375$

4b. $^{19}/_{8}$

Finding Extrema: Maximum and Minimum Points
(pages 14–16)

*Answers for x may vary.

1f.* Minimum
X = -1.499998
Y = 1.75

1g. -1.5

1h. yes

2f.* Maximum
X = 2.9999984
Y = 7

2g. $x = 3$; $y = 7$

3a.* $x = -1.7862$;
$y = 8.2088$

3b.* $x = 1.1196$;
$y = -4.0606$

An Area Problem
(page 17)

1. $x(45 - 2x)$ or
$45x - 2x^2$

2. 253.125 square meters

3. 11.25 meters × 22.5 meters

A Volume Problem
(page 18)

1. $x(9 - 2x)(12 - 2x)$

2. 81.872167 cubic inches

3. 1.6972 inches ×
5.6056 inches ×
8.6056 inches

Intersections of Graphs
(pages 19–20)

1e. Intersection
X = 3 Y = 2

2b. 2

2c. $x = -1$; $y = 2$

2d. $x = 4$; $y = -3$

3. (4, 15)

Solving Quadratic Equations Without Paper and Pencil
(page 21)

1d. $x = -2; y = 1.5$

Solving Harder Equations Without Paper and Pencil
(page 22)

1. $x = -4; x = -1; x = 2$

2. $x = .7390$

3. no solution

4. $x = -7666; x = 2$

Operations With Matrices
(pages 23–24)

1a. $\begin{bmatrix} 9 & 1 \\ 5 & 4 \end{bmatrix}$

1b. $\begin{bmatrix} -3 & 9 \\ -9 & -2 \end{bmatrix}$

2c. 1, 2 = 5

2e. $\begin{bmatrix} 9 & 1 \\ 5 & 4 \end{bmatrix}$

2f. $\begin{bmatrix} -3 & 9 \\ -9 & -2 \end{bmatrix}$

Operations With Matrices
(pages 25–26)

2. $\begin{bmatrix} 53 & 3 \\ -5 & 11 \end{bmatrix}$

3a. $\begin{bmatrix} 2 & 6 & 21 \\ -8 & 2 & -46 \\ -13 & 8 & 2 \end{bmatrix}$

3b. $\begin{bmatrix} 3 & -4 \\ 12 & 4 \\ 9 & 2 \end{bmatrix}$

4a. $\begin{bmatrix} 3 & -1 \\ -5 & 2 \end{bmatrix}$

4b. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

5b. -13

5c. 79

Operations With Matrices
(pages 27–28)

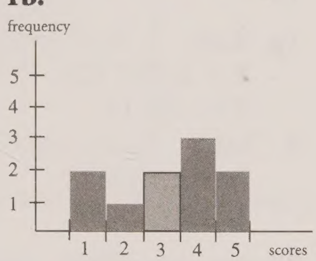
1b. 2×1

1c. $\begin{bmatrix} 4 \\ 6 \end{bmatrix}$

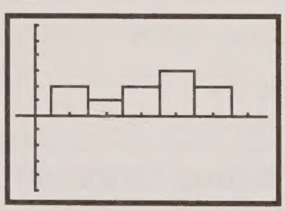
2. $\begin{bmatrix} 8 \\ -2 \\ -4 \end{bmatrix}$

Plotting Data: Histograms
(pages 29–32)

1b.



2h.



3a.–c. Answers will vary.

3d. $\frac{1}{6}$; $16\frac{2}{3}$%

Plotting Data: Box and Whisker Plots *(pages 33–35)*

1a. 97

1b. 52

1c. 45

1d. 78

2i. Med = 78

2j. maxX = 97

2k. minX = 52

2l. Q1 = 65
Q3 = 87

One Variable Statistics *(page 36)*

1e. 1-Var Stats
↑n = 11
minX = 52
Q1 = 65
Med = 78
Q3 = 87
maxX = 97

Writing Linear Equations Given Two Points
(pages 37–39)

1b. Answers will vary depending on the length of the line segment drawn.

2f. Answers will vary but *a* should be about 2.5 and *b* should be close to 0.

2g. Answers will vary.

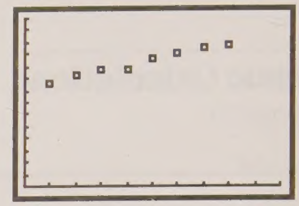
2h. The equation from 2g passes through the two data points.

3. $y = 1.8x + 32$ or degrees Fahrenheit = 1.8 ∗ (degrees Celsius) + 32

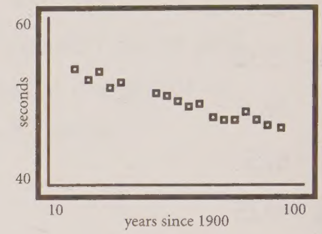
Plotting Data: Scatter Plot Graphs *(pages 40–42)*

1f. no

1g.



2a.



2b. $y = -0.0959x + 55.4722$

Programming
(pages 43–45)

1h. °F = 104
Done

1i. 41; 98.6; 14

2. :Input "ENTER CM:", C
:(1/2.54)C→I
:Disp "INCHES=", I

An Introduction to the TI-82 Graphing Calculator

About the Book

An Introduction to the TI-82 Graphing Calculator is a great tool to use to help students become familiar with the TI-82 graphing calculator. Featured in this book are lessons that lead students step-by-step through problems and solutions that highlight some of the most useful features and commands on the TI-82. Extra problems are provided at the end of some lessons for students to practice.

You and your students will be pleased as they gain proficiency in using the TI-82 and discover many more applications for it.

About the Author

Mark Govatos has been teaching math classes ranging from elementary math to Advanced Placement Calculus for 15 years in private schools in Southern California. For the last six years, he has been the chairman of the math department at Crossroads School in Santa Monica, California, where he currently teaches. Mr. Govatos is also the Assistant Director of the W.M. Keck Math/Science Institute at Crossroads School and is a member of the Professional Services Committee of the California Association of Independent Schools.

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